FLOWERS THAT GIVE LIGHT

By James Carter Beard

Prof. E. M. Fries Investigating the Cause of Phosphorescence in Plants

PARK COMMISSIONER MAURICESON, a few years ago, sent from the park conservatory in Golden Gate park, San Francisco, a remarkable statement, to the effect that a certain species of Australian poppy (*Papaver australia*) possesses the peculiar property of lighting up at night and emitting a steady glow.

When Mr. Mauriceson first observed the phenomenon, although he was aware that accounts existed of something similar that had been witnessed before, he could not quite persuade himself that he was not suffering from some deception. "Noticing," he says, "that light from flowers seen by others is recorded as being intermittent, while that from the Australian poppies is constant, I came to the conclusion that I was the victim of a practical joke, sincerely believing that someone had mischievously painted the flowers with luminous paint.

"Determined to satisfy myself, I secured one of the light-emitting plants and immediately conveyed it to my friend Mr. Daniels, an amateur microscopist in whose skill I had every confidence, asking him to make a thorough and careful examination of the petals of the flower, with a view to ascertaining if they had been treated with any kind of a preparation. This he did, with the result that his examination showed conclusively that the flower was entirely free from foreign substances of the nature I had suspected.

"It was then that I ventured to announce that the park was the possessor of a most remarkable flower, while the San Francisco papers went so far as to state that it was the only one of its kind ever brought to the United States."

Every night during the time that the luminosity remained visible the park commissioners proudly pointed out the antipodal flower to the multitudes that came to see and admire it.

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Of all physical and chemical properties belonging to nature, that of phosphorescence is perhaps at once the most inexplicable and most interesting; and of all the phenomena exhibited, in the self-luminosity of creatures and of things most pleasing is the phosphorescence of flowers and of plants, adding, as it does, an almost spiritual glory to the charm of their beautiful form and color. To a woman is due the credit of having called attention to the fact that certain flowers have the property of shining by their own light, this observer being the daughter of the great Swedish naturalist Linnæus. In June and July, 1762, she observed radiations of light from a cluster of garden nasturtiums (*Tropæolum majus*), which occurred in the morning or in the evening twilight.

The same phenomena has been observed in other flowering plants, the corolla of the sunflower, the French and African marigold and the yellow lily.

It will be noticed that all of these flowers are either orange or yellow in color, and the fact points to a curious and unexplained law regarding phosphorescence, that the luminosity of an object tending to shine by phosphorescent light is enhanced by the fact that the luminous body, whether it belongs to the mineral, vegetable or animal kingdom, is of a yellow or an orange color. Sir Isaac Newton, who first discovered that white sunlight was made up of the different colored rays that compose the spectrum, says: "The most luminous of the prismatic colors are the yellow and the orange; these affect the senses more strongly than do all the rest together."

All this, however, does not prevent flowers of other colors than yellow and orange from giving out perceptible though faint flashes of phosphorescent light. Besides those mentioned, the dahlia, the tuberose and the four o'clock have been recorded as phosphorescent.

Not only the blossoms, indeed, but the leaves of many flowering plants emit light under favorable atmospheric conditions; even the milky sap of the so-called phosphoric spurge, or *Euphorbia*, and of several other vegetable growths become luminous in the dark.

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With regard to the comparative intensity of the light given out by the flowers that he had observed, Professor Haggern, who seems to have devoted considerable thought and time to the subject, writes: "The luminous radiations of the marigold I have found to be the most brilliant, next to which I place the light given out by the nasturtium, and third that of the yellow lily. A careful microscopic examination has convinced me that the light does not depend upon the presence of any animal organism."

Professor Haggern's attention was drawn to the subject by perceiving, one evening, a flash of light repeatedly dart from a marigold. Much surprised at so unusual an appearance, he determined to investigate the matter, and to assure himself that he was not deluded he stationed his gardener in the immediate vicinity, directing him to throw up his hand the moment the light appeared. The man's signals corresponded perfectly with his own observations. He is careful to record that the illuminations of the marigolds of an orange or flame color were the most brilliant, while those of the pale flowers were scarcely discernible. Occasionally the same flower flashed up several times in rapid succession, but oftener at intervals of several minutes, and when a cluster of blossoms shone at the same moment the light could be seen at a considerable distance.

Haggern thinks that the light is electrical. The phosphorescence in flowers observed by Sara von Linné had the appearance of an electric spark which shot out from the corolla and was discernible at the same hour on warm evenings, when the air was surcharged with electricity.

The radiance, too, observed by Professor E. M. Fries, the Swedish botanist, in a group of poppies (*Papaver oriental*) in the botanical gardens at Upsala, indicated a periodicity of time and identity of conditions, always occurring when the air was electrical, between ten and eleven o'clock at night.

In view of such facts, together with the evidence furnished by his own observations, Professor Haggern constructed a theory of electrical action, induced by physiological changes in the plant, to account for its light-giving properties.

The trouble with the professor's theory, granting all that he claims for it, is that, like a good many other theories on a great many other subjects, it seems to be framed to meet a few particular cases, and that it calmly ignores all the rest; thus leaving the problem, as a whole, as much a problem as it was before.

And yet, what other explanation can be suggested for the phenomena? The light certainly appears very much like that "emitted by a small Crookes or Geissler tube when a current of electricity is passed through it."

But, on the other hand, instances occur in which the light is comparatively constant and steady, as in the case of the Australian poppies at the Golden Gate park, and other flower lights observed and recorded, besides the radiance emitted by cryptogamic plants, many of which are phosphorescent.

In addition to this, the experiment has been tried of immersing these light-giving flowers in jars of oxygen gas, when, we are assured, the light is much more brilliant, while in other gases, such as nitrogen or carbonic, no light is visible. This seems to dispose of the electrical theory. It has been suggested that "a slow combustion" may account for the light, though it is impossible to ascertain what substance is consumed, and there is, of course, no sensible heat.

Can it be possible that the light given out by plants is analogous to the Röntgen, or X-ray, or those that flow from radium? Perhaps a few new well-contrived and conducted experiments with regard to flower-light might possibly be not entirely without result.

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The quality of phosphorescence is much more largely possessed by some of the cryptogamic or flowerless plants than by others. There is a charming little plant (*Schistostega osmundacæ*), so-called, first because it gathers on the crystalline rocks having a foliated structure, called schists, and also because it resembles in miniature the beautiful royal fern, *Osmunda*. Like the true cavern mosses, this plant is emerald green, but the light given out by its root-hairs is brilliant yellow.

But there is indeed no need to go far for examples of phosphorescent fungi. A decaying potato or other vegetable is often a field for the display of a brilliantly luminous fungoid growth, so brilliant indeed that, as we are assured by a scientific writer, an alarm of fire was once raised on the streets of Strasburg from a decaying mass of potatoes collected in a cellar. Most of us, it may be supposed, are familiar with fox-fire that shines from decaying wood, sometimes quite brightly, and know that it is not the wood but an investing growth of fungus that emits the light. The Rev. Mr. J. M. Berkely cites an instance in England where "a dazzling radiance was observed upon a spruce or larch log, which continued for several days, a byssoid *mycelium* yielding an usually pungent odor, being recognized." Thready masses of root fibers from fungoid growths penetrate decaying organic matter, and coal deposits in mines give a pale mimicry of light that imparts a weird charm to subterranean galleries and chambers, as if masses of moonlight had strayed from the world above and lost themselves amid underground

Daughter of Swedish Botanist, Carolus Linnaeus, Observing Brilliant Phosphorus of Garden Nasturtiums in 1762